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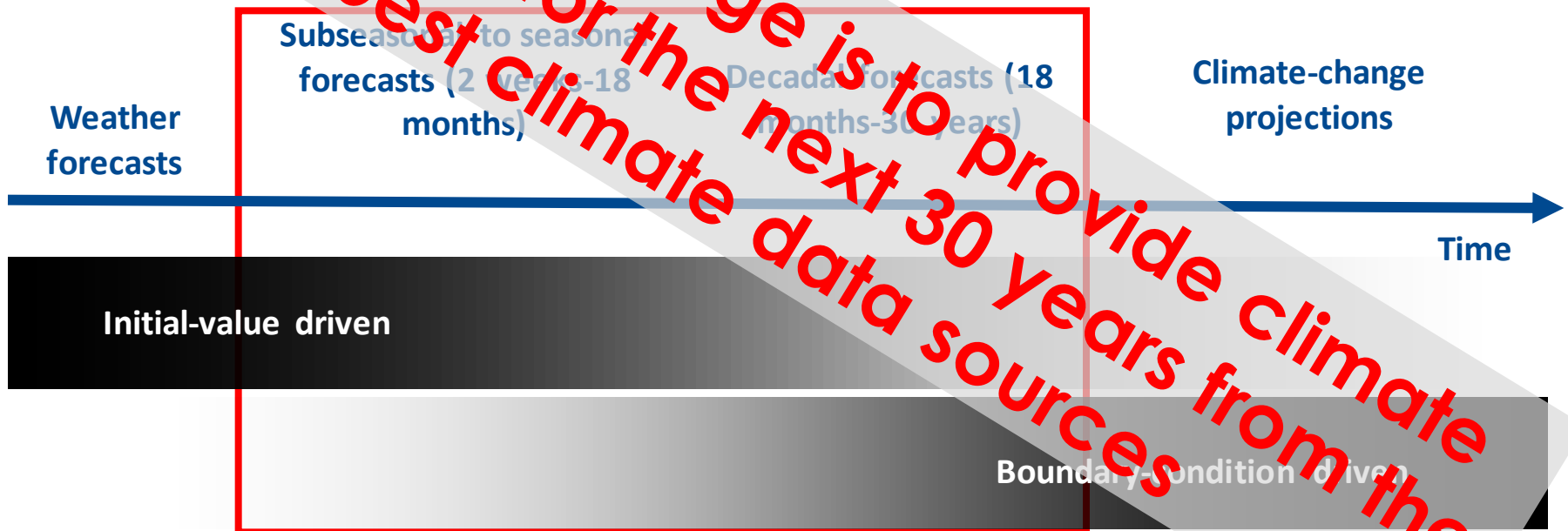


Climate information for the next two decades: A user perspective

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Barcelona Supercomputing Center

- This presentation is not just about predicting climate.
- This presentation is about the need to provide action-oriented climate information for the next 20-30 years.
- Decadal predictions should contribute to the formulation of statements about climate variations for the next 30 years; **but 30 years involves merging predictions and projections.**
- Climate predictions, understood as initialised ensemble simulations up to 10 years, allow to both **phase in the internal variability and correct the forced model response.**
- Close links exist with climate services (GFCS) and WMO CCI.
- Many stakeholders make decisions on multiannual to interdecadal time scales.

Progression from initial-value problems with weather forecasting at one end and multi-decadal to century projections as a forced boundary condition problem at the other, with climate prediction (sub-seasonal, seasonal and decadal) in the middle. Prediction involves initialization and systematic comparison with a simultaneous reference.

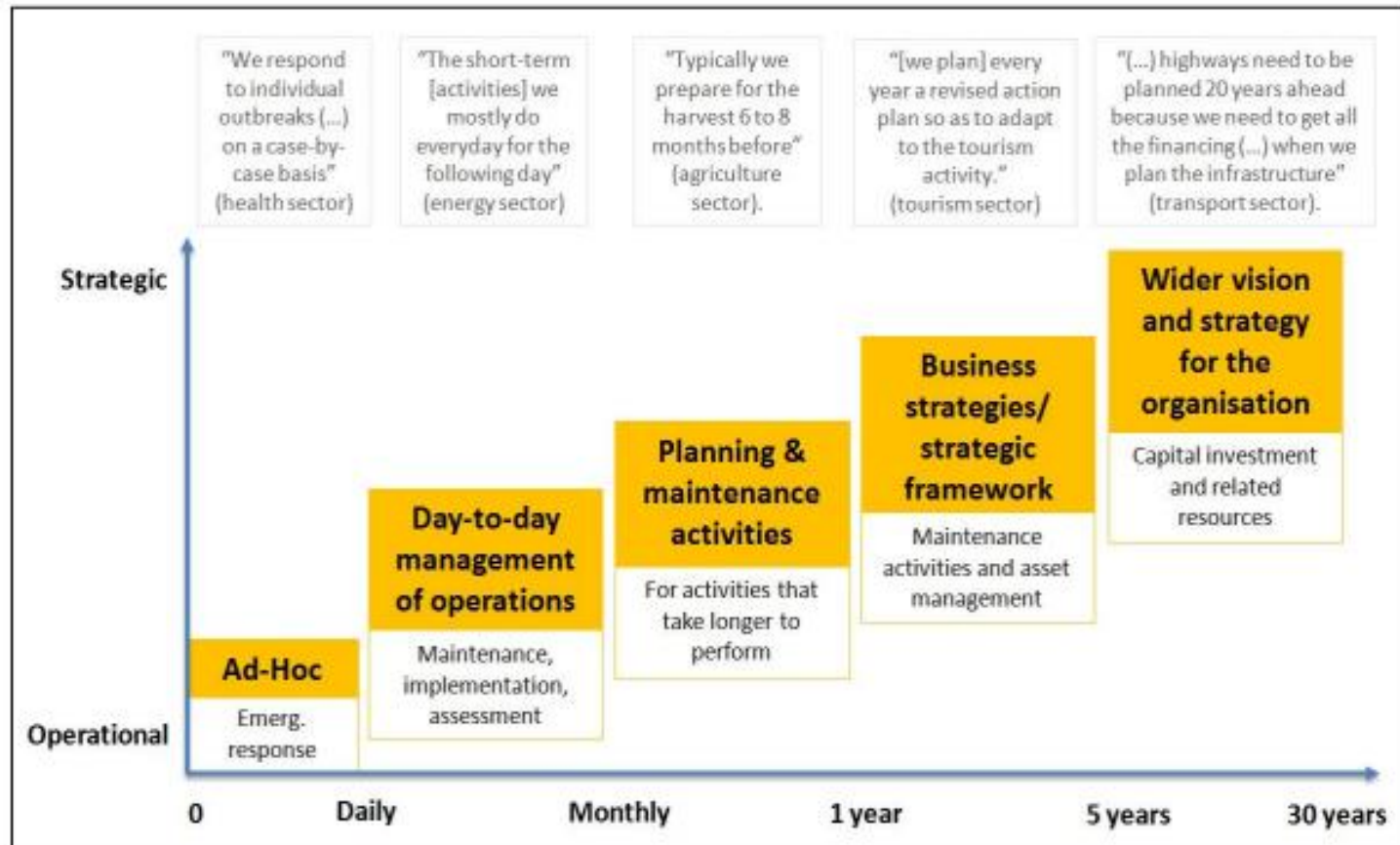


Near term: A user's view



Mid-term planning (1-5 yr): business strategies often linked to annual capital investment plans

Long-term planning (5-30 yr): wider vision and strategy, and associated resources and capital investment



In all sectors there are potential applications but in some sectors the decision making processes that would benefit from decadal predictions are better defined.



Provided the added value of predictions-projections is illustrated to the users.

User requests for the near term



Bodegas Torres (a Spanish winery) is looking for new locations for its vineyards (and it's not the only one doing it).

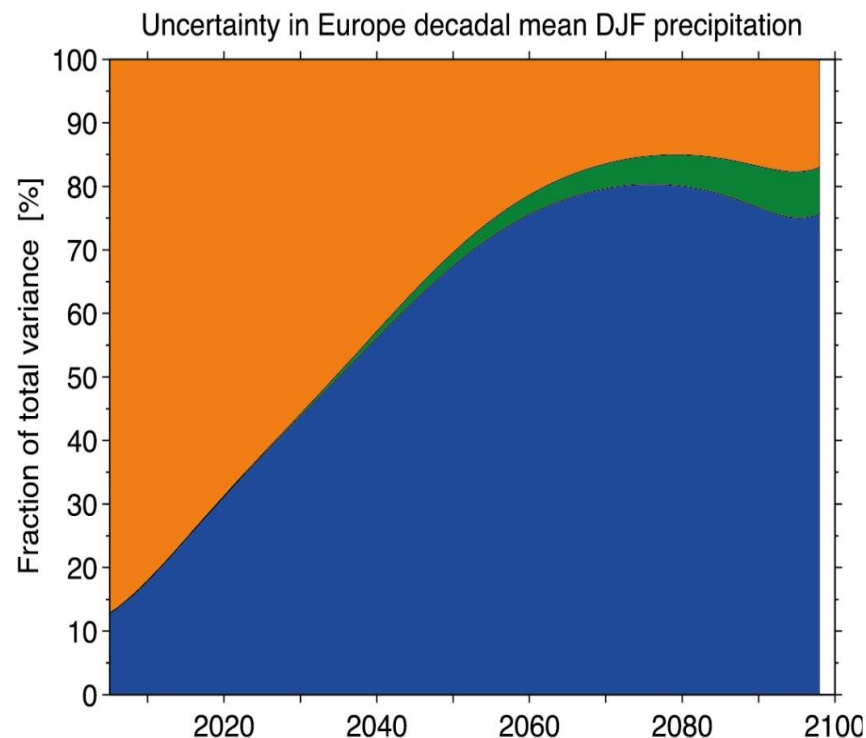
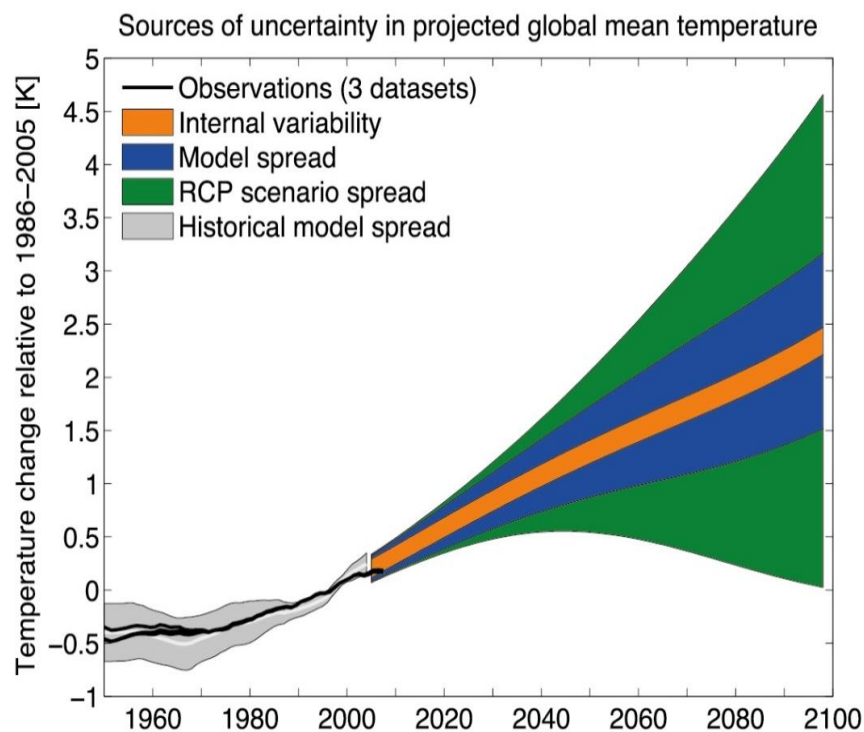
Land is being purchased closer to the Pyrenees, at higher elevation. They are considering acquiring land in South America too, in areas where wine is currently not produced.

Bodegas Torres needs local climate information (including appropriate uncertainty assessments) for the vegetative cycle of the vine, which lasts around 30 years.

The user needs to make the decision now.

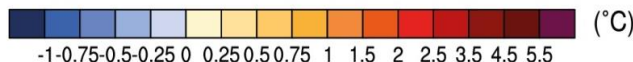
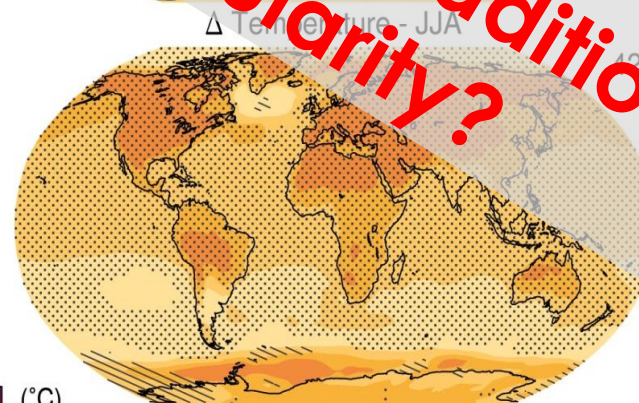
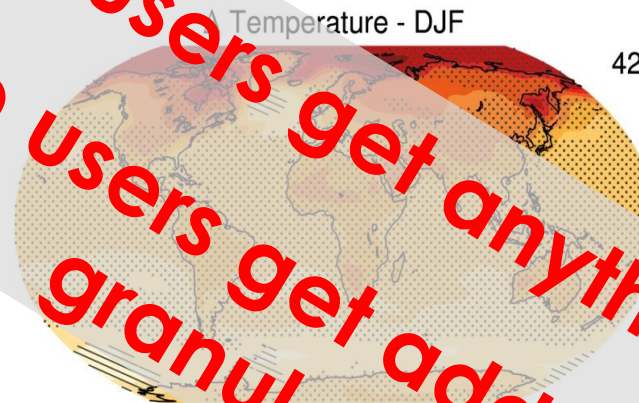


The sources of uncertainty include the internal variability, model differences and scenario spread. The internal variability is an uncertainty source particularly important for the near term that could be reduced, especially at regional scales.



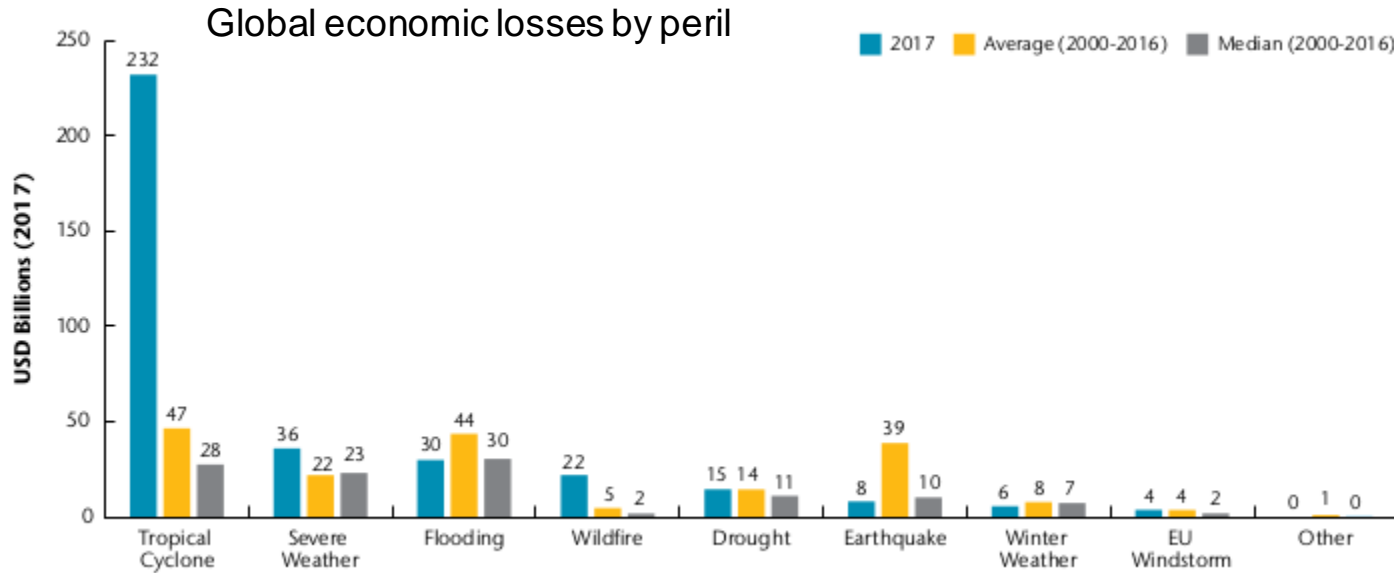
Seasonal-mean air temperature change for the RCP4.5 scenario over 2016-2035 (wrt 1986-2005). Stippling for significant changes, hatching for non-significant.

The meridional gradient decreases (it increases at the tropopause).



Can the users get anything better?
Can the users get additional time
granularity?

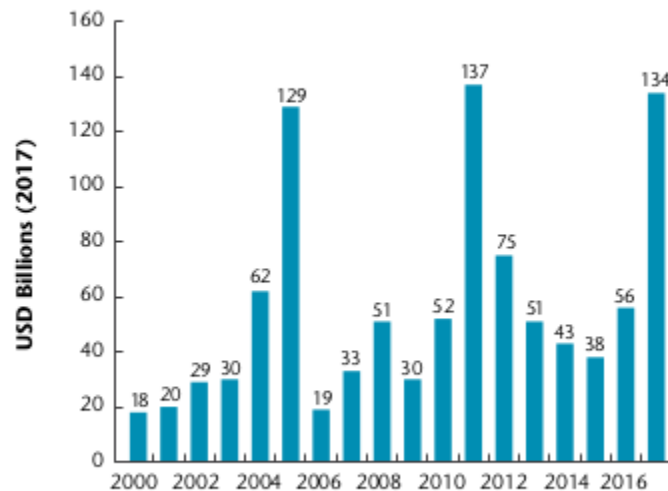
Insurance: tropical cyclones



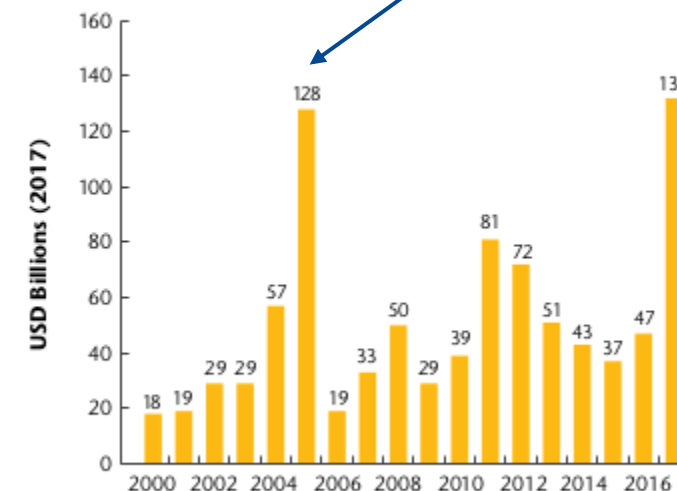
Source: Aon Benfield

Global insured losses

All natural disasters



Weather only



Katrina


Harvey, Irma, Maria

- Seasonal forecasts would be relevant for tropical cyclone frequency prediction because it is strongly impacted by ENSO.
- However, the insurance sector is not free to adjust their rate based on the annual risk. There are laws that prevents them from hiking their rates if they see a La Niña forming, for example.
- The sector can only use climate information by developing a view of risk on a multiannual basis. The standard is now five years.
- And that's where decadal forecasts enter as a valuable source of climate information.

nature
geoscience

Letter | Published: 07 November 2010

Skilful multi-year predictions of Atlantic hurricane frequency

Doug M. Smith , Rosie Eade, Nick J. Dunstone, David Fereday, James M. Murphy, Holger Pohlmann & Adam A. Scaife

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Multiyear Predictions of North Atlantic Hurricane Frequency: Promise and Limitations

[Gabriel A. Vecchi](#), [Rym Msadek](#), [Whit Anderson](#), [You-Soon Chang](#), [Thomas Delworth](#), [Keith Dixon](#), [Rich Gudgel](#), [Anthony Rosati](#), and [Bill Stern](#)
Geophysical Fluid Dynamics Laboratory, NOAA, Princeton, New Jersey

Geophysical Research Letters

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Multiannual forecasts of Atlantic U.S. tropical cyclone wind damage potential


Louis-Philippe Caron , Leon Hermanson, Francisco J. Doblas-Reyes

Geophysical Research Letters

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Forecast cooling of the Atlantic subpolar gyre and associated impacts

Leon Hermanson , Rosie Eade, Niall H. Robinson, Nick J. Dunstone, Martin B. Andrews, Jeff R. Knight, Adam A. Scaife, Doug M. Smith

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[Climate Dynamics](#)

May 2014, Volume 42, [Issue 9–10](#), pp 2675–2690 | [Cite as](#)

Multi-year prediction skill of Atlantic hurricane activity in CMIP5 decadal hindcasts

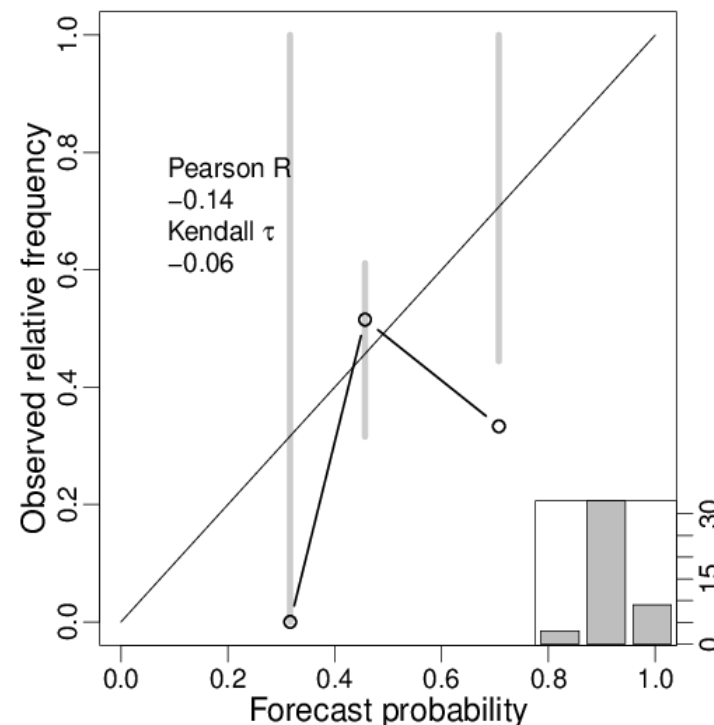
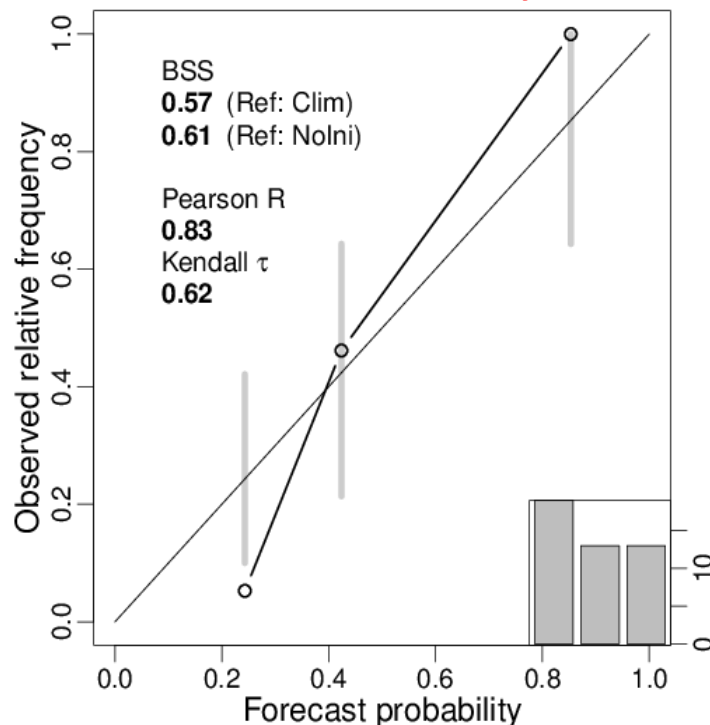
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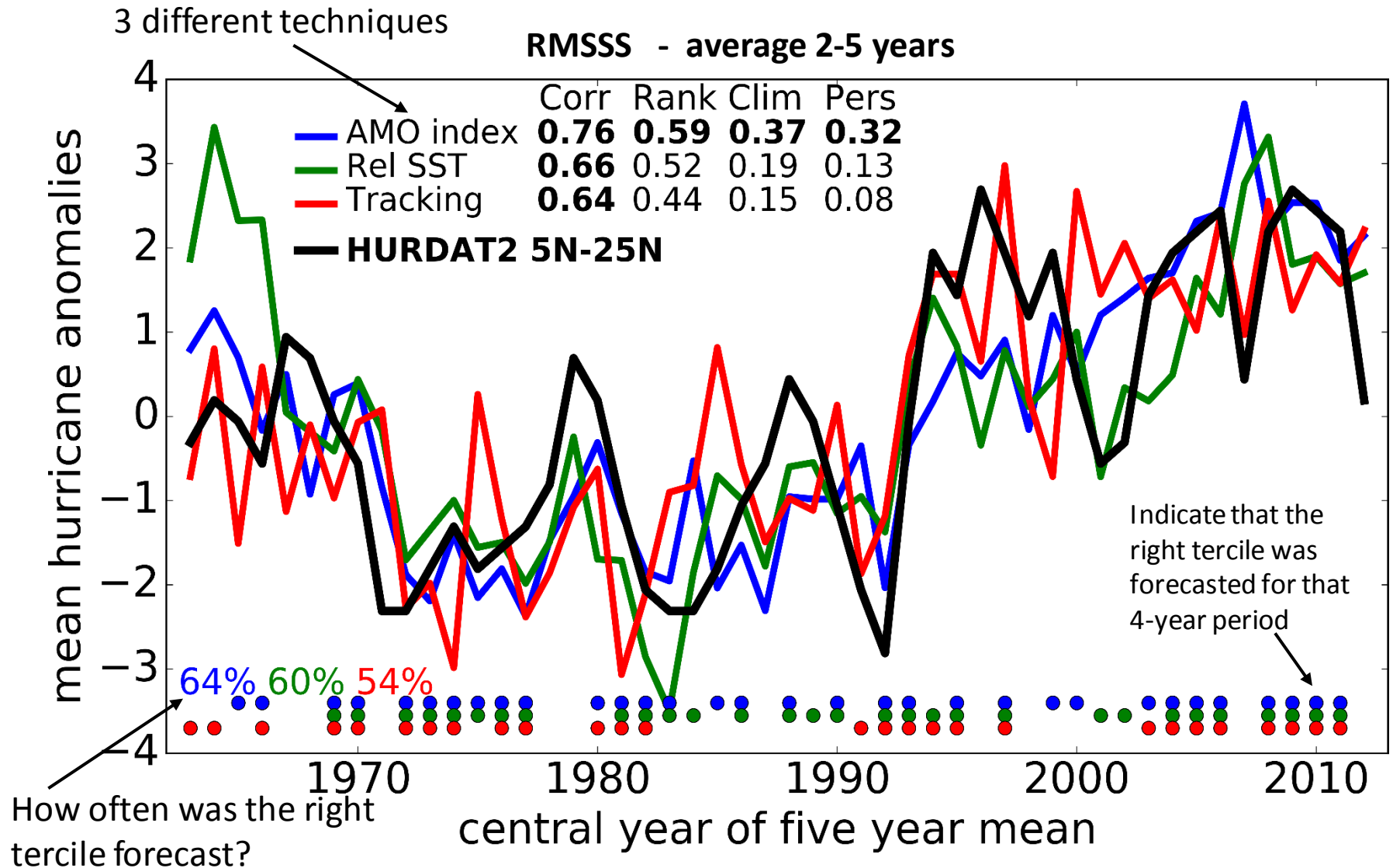
Louis-Philippe Caron , Colin G. Jones, Francisco Doblas-Reyes

Reliability diagrams of (left) initialised and (right) uninitialised multi-model simulations for basin-wide **accumulated cyclone energy (ACE)**. The results are for 2-9 year averages above the climatological median over 1961-2009. Statistically significant values are in bold.

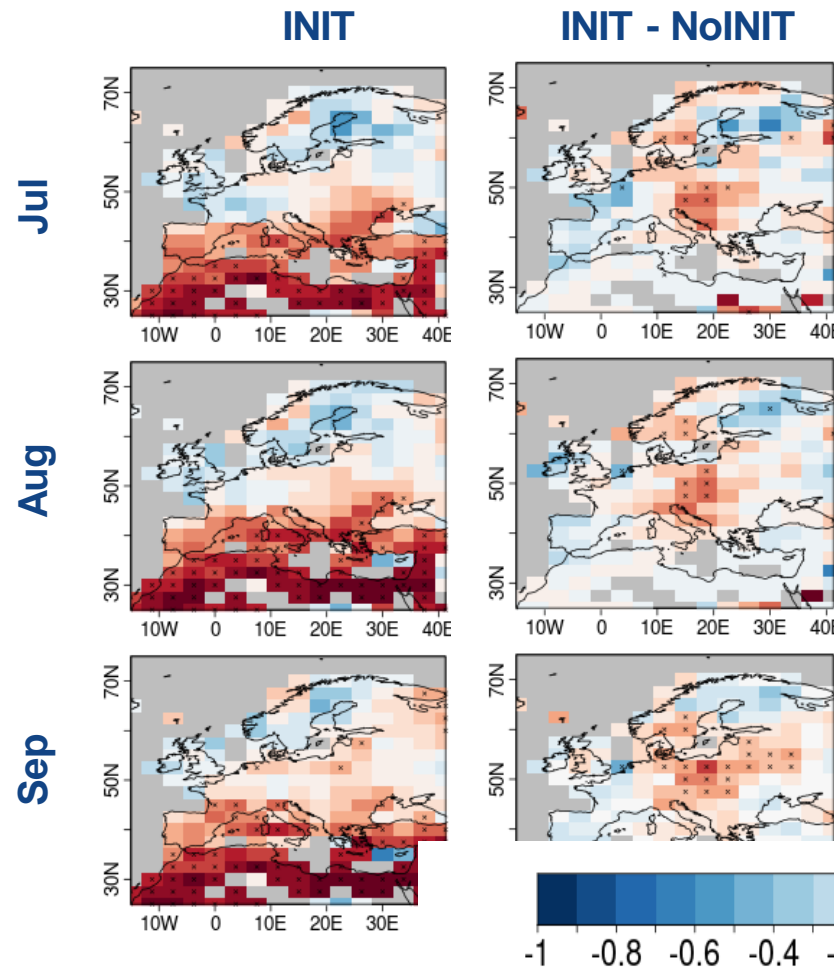
Some of the added value of the predictions is their better management of uncertainty, which leads to increased **credibility**.



Insurance: tropical cyclones

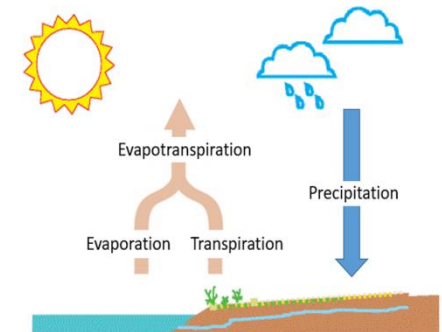


Multi-model correlation between the predicted ensemble mean and reference (from GHCN and GPCC) standardised precipitation evapotranspiration index of the previous six months (SPEI6) for the boreal summer averaged over forecast years 2 to 5.

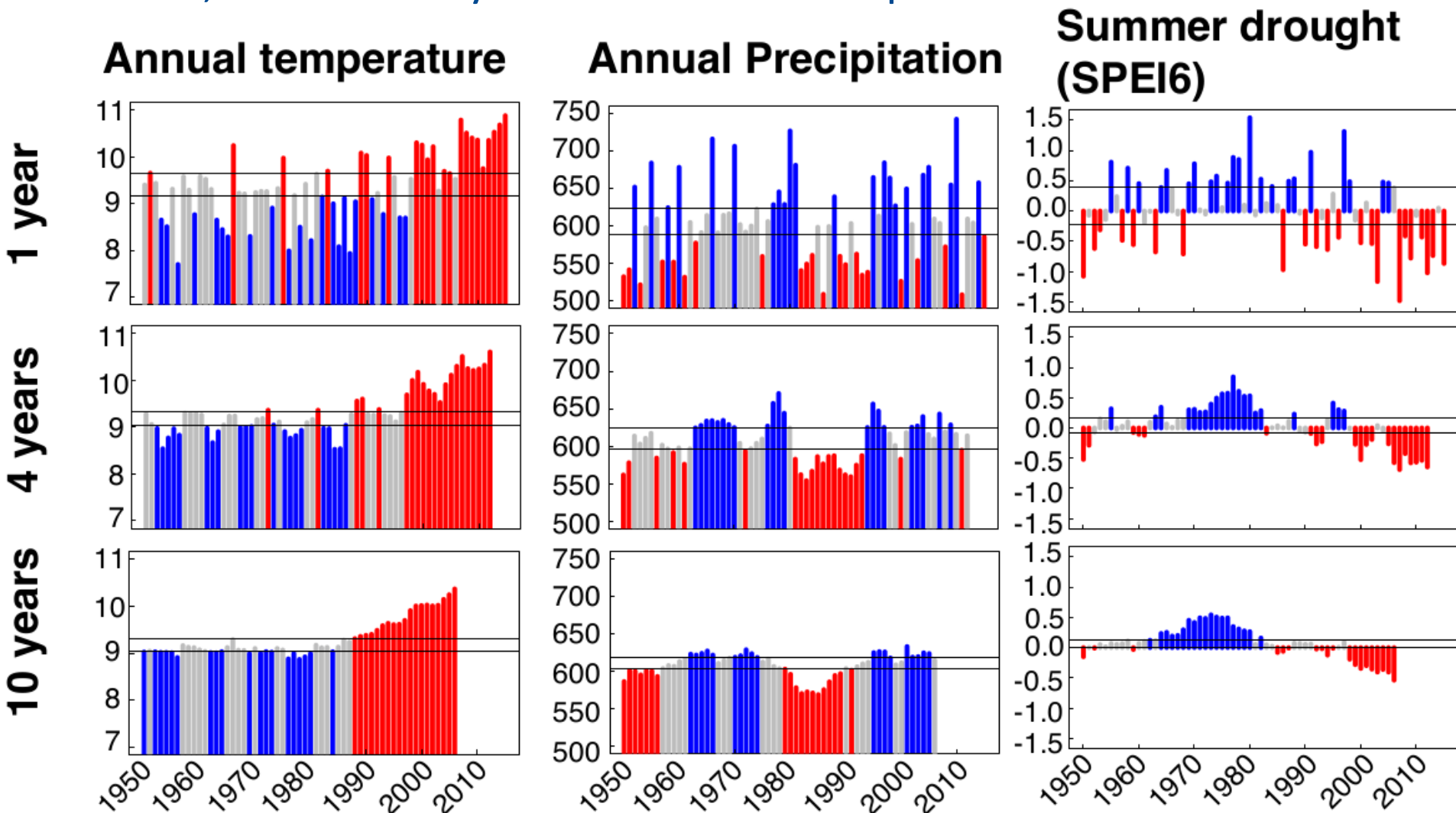


INIT: Initialized decadal prediction

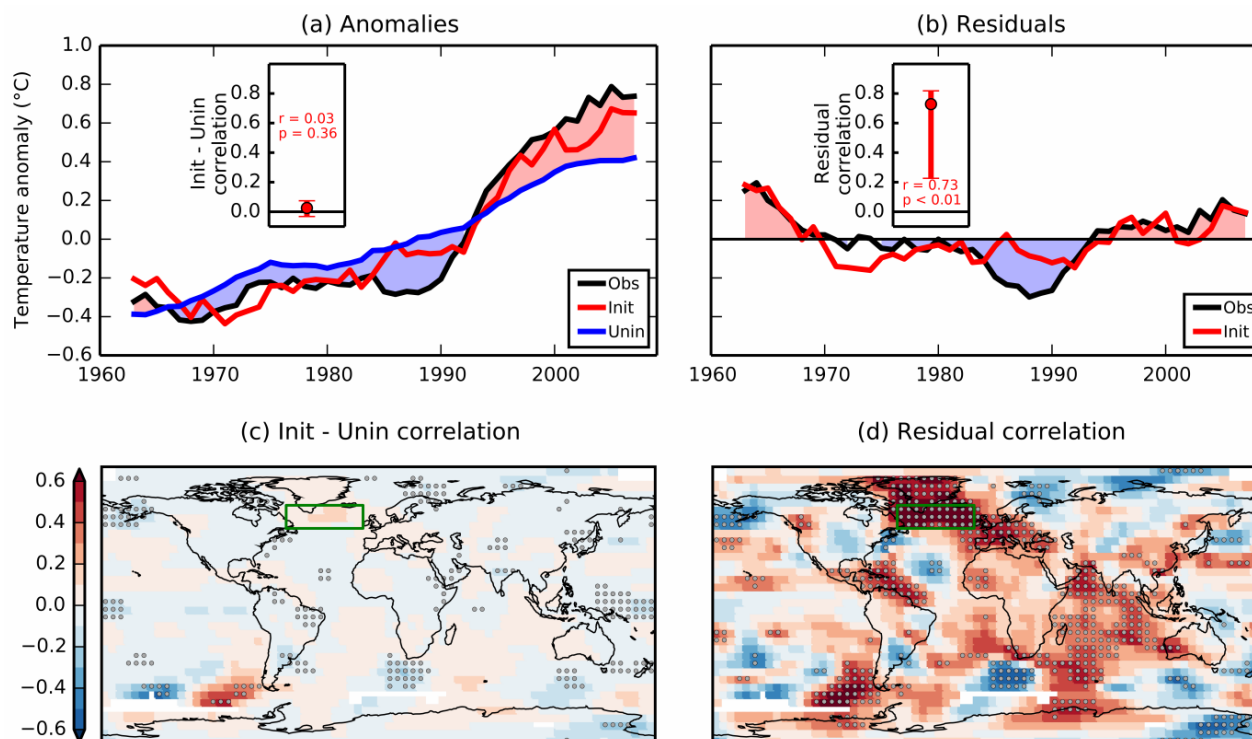
NoINIT: Non initialized climate projection



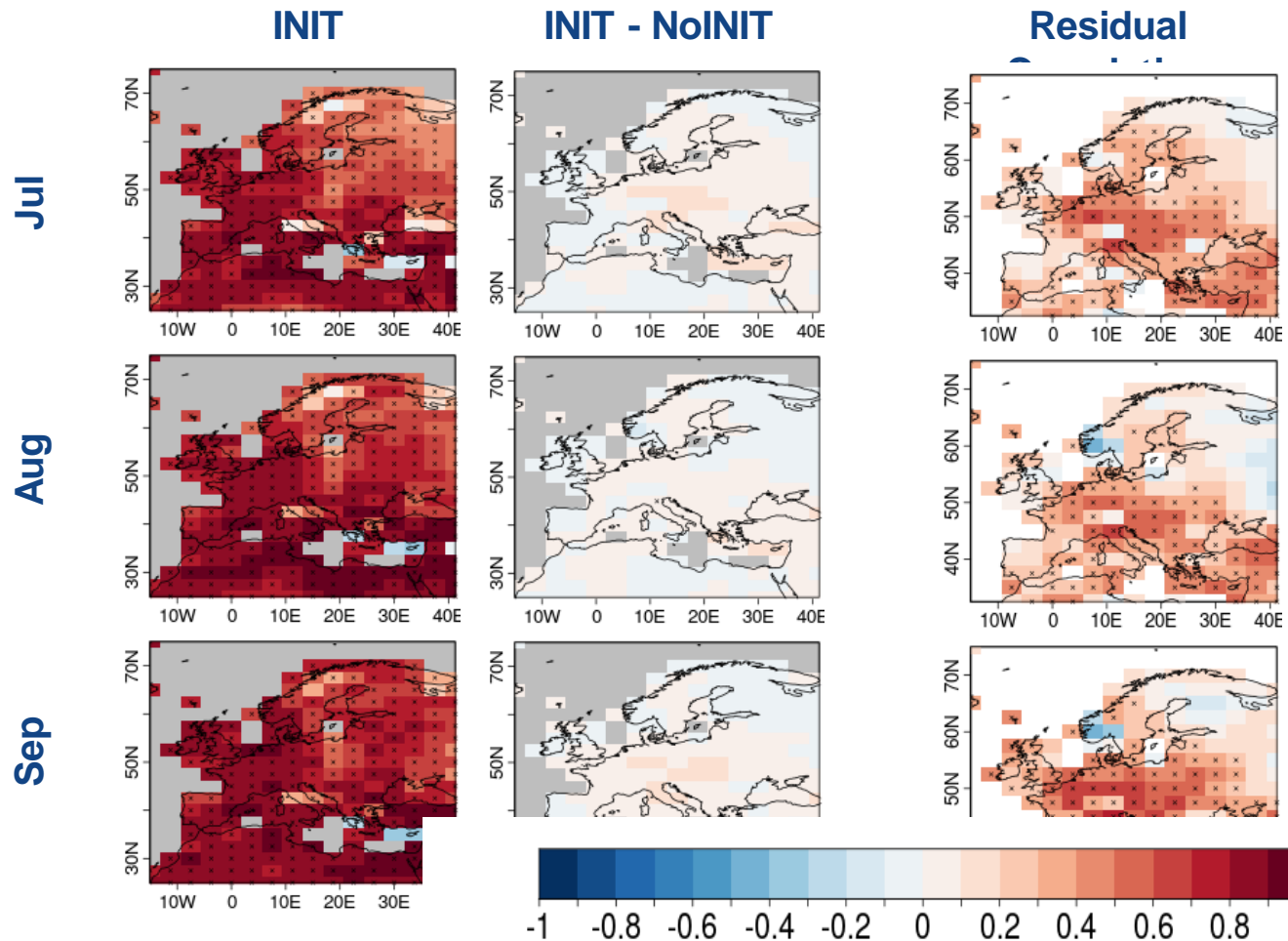
Time series of temperature, precipitation and August SPEI6 averaged over one, four and 10 years in Eastern Europe.



(Top) Time series of 8-year running mean JJA sub-polar North Atlantic (60-10W, 50-65N) temperature. The right panel shows the residual of the observations and decadal predictions regressed against the non-initialised simulations. (Bottom) Impact of initialisation measured by the difference between initialised and uninitialised correlation for years 2-9 JJA near surface temperature.



Multi-model correlation between the predicted ensemble mean and reference (from GHCN and GPCC) standardised precipitation evapotranspiration index of the previous six months (SPEI6) for the boreal summer averaged over forecast years 2 to 5.



CRITICAL ENERGY INFRASTRUCTURES IN GERMANY

— RECOMMENDATIONS —

“

Stakeholders...

Have a low awareness of
existing climate services

Have a huge demand for
seasonal and decadal
predictions

KEY MESSAGES

Have a positive perception of
risks and low risk awareness

”



Raise awareness on the availability of
climate services



Set up a 'Climate Services Provider
Store' to inform key actors on climate
service providers for their case-specific
needs

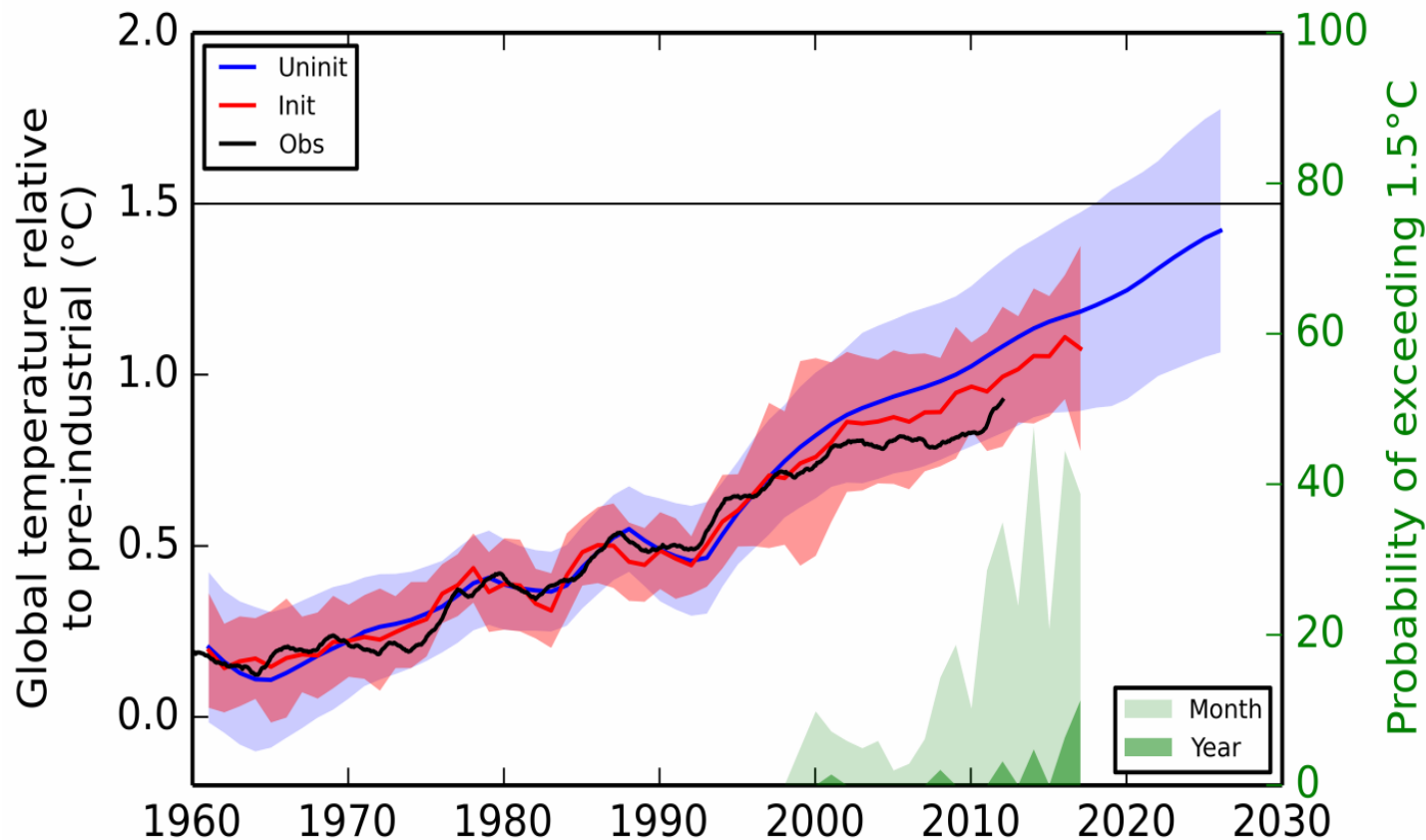


Increased funding and research on the
field of decadal climate research



Mainstream cooperation between
energy networks and climate services
providers

Multi-model rolling five-year global-mean air temperature from non-initialised and initialised simulations and probability of exceeding 1.5°C for either a month (light green) and year (dark green) with respect to pre-industrial (1850-1900) levels.



- Decadal prediction contributes to CMIP6 via DCPD.
- There is a real-time forecast exchange promoted by the WCRP Grand Challenge on Near-Term Climate Prediction.
- The operationalisation of decadal prediction by the WMO Commission of Climatology.
- It is very important to use the same model configurations as for other climate experiments; learn about your model, use the hierarchy that is likely available.

The multi-model real-time decadal prediction exchange is a research exercise that guarantees equal ownership to the contributors.

BSC is one of the four centres recognised as global producers of decadal climate predictions by WMO-CCI.

Multi-model decadal forecast exchange

The Met Office coordinates an informal exchange of near-real time decadal predictions. Many institutions around the world are developing decadal prediction capability and this informal exchange is intended to facilitate research and collaboration on the topic.

[The contributing prediction systems](#) are a mixture of dynamical and statistical methods. The prediction from each institute is shown below, alongside an average of all the models. When possible, observations for the period of the forecast are also shown. Currently three variables are included: surface air temperature, sea-level pressure and precipitation. These are shown as differences from the 1971-2000 baseline. More diagnostics, including ocean variables are planned for the future. Please use the drop-down menus below to explore the data collected to date.

This work is supported by the European Commission SPECS project.

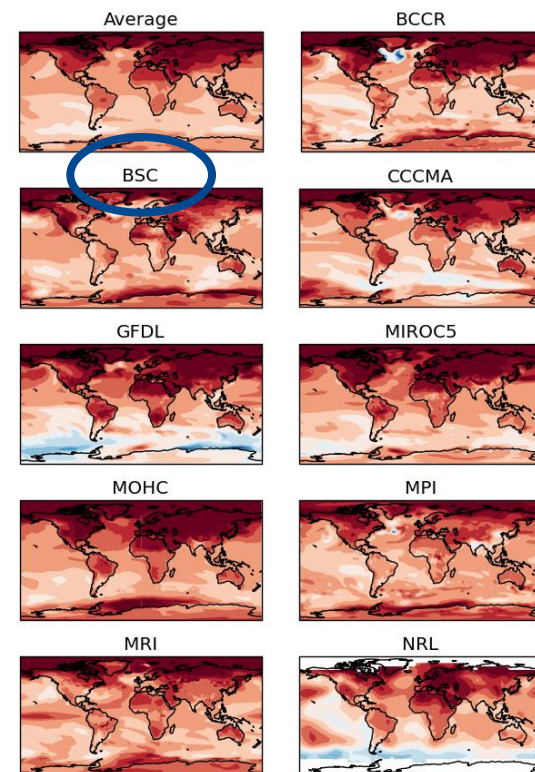


To learn more about decadal forecasts at the Met Office, see our current [decadal forecast](#).

Images last updated 2014-06-25

Issued Period Element

2017 predictions for 2018-2022 surface temperature



- Targeted products need to become **widely available, easy to access** and understand by different professionals
- Need to understand how the information provided can be used and **integrated in users' operations and activities.**
- **Added value** of using decadal predictions needs to be better understood. The chain product-verification-predictability source needs to be established.
- Need to **reduce uncertainties and increase the skill.** The skill is too low to base decisions on them, since the cost/lost ratio can be high
- Better explanation of the **link between decadal predictions and climate change projections.**
- The information needs to be **reliable** enough.
- Maybe need for **fine spatial resolutions** or allow focusing on local urban areas.

- Requests for climate information for the next 30 years comes from a **broadening range of users** and should be addressed from a climate services perspective. What forecasters provide is still far from what some users demand (even in the absence of skill) and is only part of a complex story.
- **Different tools** are available to provide near-term climate information (global and regional projections, decadal predictions, empirical systems, etc.). **Merging all this information** into a reliable, unique source is a problem still not solved.
- **Decadal prediction**, as a contributor, **is already an operational activity**.
- **Standards** for verification, data dissemination, quality control need to be established.
- None of this will materialise without appropriate **investment in observational networks, increased collaboration and reduction of all aspects of model error**.